POPLAR RIVER

COOPERATIVE MONITORING ARRANGEMENT

TECHNICAL MONITORING SCHEDULES

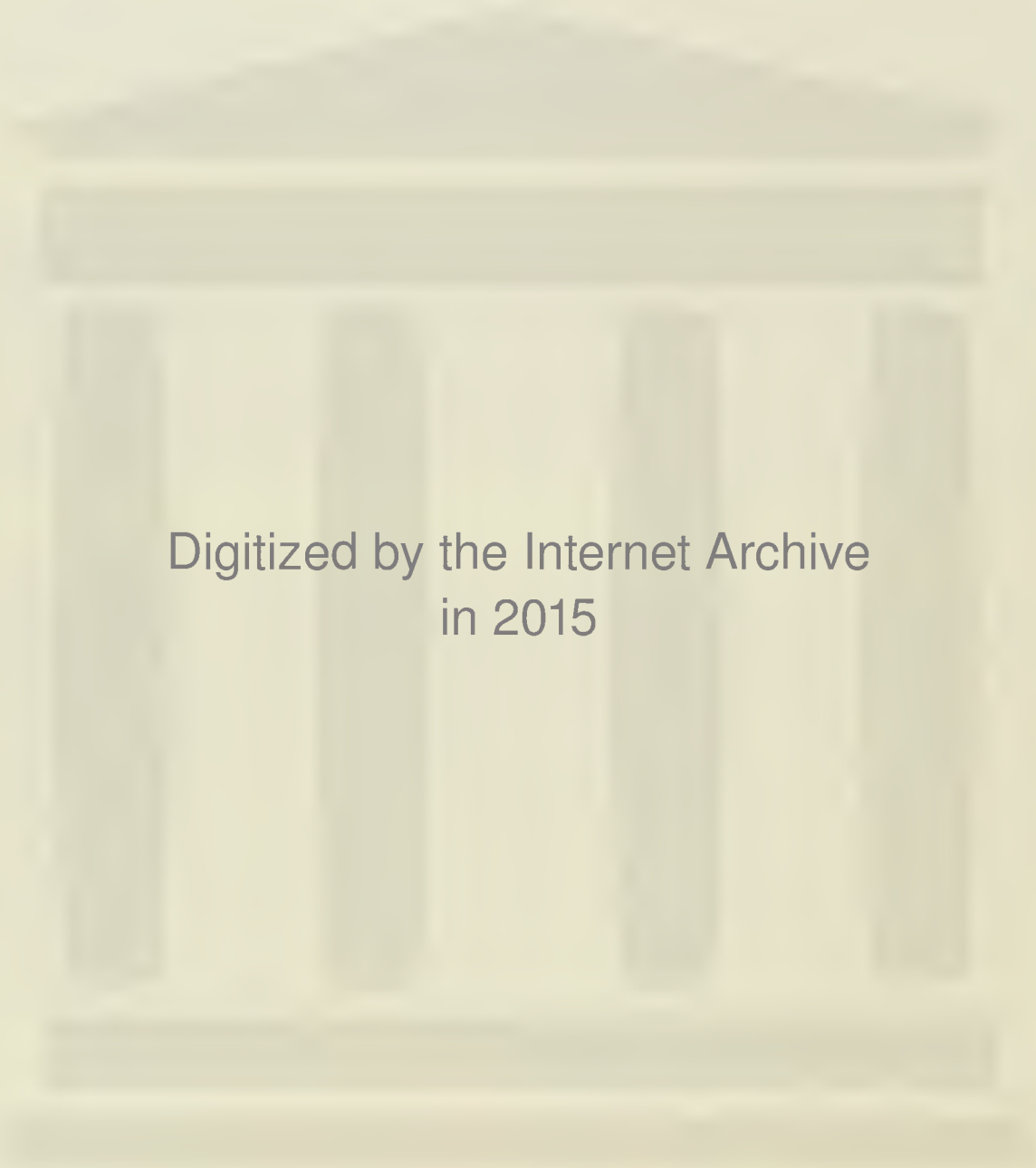
September, 1980

PREAMBLE

The Technical Monitoring Schedule lists those water quality, water quantity and air quality monitoring locations and parameters which form the basis for information exchange and reporting to governments. The Committee structure is described in the Poplar River cooperative monitoring arrangements.

The monitoring locations and parameters listed herein have been agreed to by governments and represent the basic technical information needed to identify any definitive changes in water quality, water quantity and air quality at the international boundary. Changes to the sampling locations and parameters may be made by governments based on the recommendations of the Committee.

Significant additional information is being collected by agencies on both sides of the international boundary, primarily for project management or basin wide baseline data purposes. This additional information is usually available upon request from the collecting agency and forms part of the pool of technical information which may be drawn upon by governments for specific study purposes. Examples of additional information are water quality, water quantity, groundwater and air quality data collected at points in the Poplar River basin not of direct concern to the Committee. In addition, supplemental information on parameters such as vegetation and soils, fish population, waterfowl and aquatic vegetation is also being collected on either a routine or specific studies basis by various agencies.



POPLAR RIVER

COOPERATIVE MONITORING ARRANGEMENT

TECHNICAL MONITORING SCHEDULE

CANADA

STREAMFLOW MONITORING
AT HYDROMETRIC GAUGING STATIONS

Responsible Agency: Environment Canada

Daily mean discharge or levels and instantaneous monthly extremes as normally published in surface water data publications.

Index No.	Station Name
1. 11AE003 (06178500)	East Poplar River at International Boundary
2. 11AE008 (06178000)	Middle Fork Poplar River at International Boundary
3. 11AE013	Cookson Reservoir near Coronach

HYDROMETRIC GAUGING STATIONS

SURFACE WATER QUALITY MONITORING

Responsible Agency: Saskatchewan Environment

No. on Map	Station	Sampling Frequency	Parameters
1	Fife Lake Overflow	Weekly during overflow	ph, cond, temp, B.
		Once during each period of overflow greater than 2 weeks' duration	Above plus D.O., major ions, TDS, NO_3, TKN, TP, TIC/TOC, TSS, VSS, Tot Col, Fec Col.
2	Girard Cr. S. of town of Coronach	Quarterly	D.O., Temp, pH, Cond, major ions, TDS, No_3, B, TKN, TP, TIC/TOC, TSS, VSS, Tot Col, Fec Col, chlorophyll
3	Upper end of Cookson Res. @ Hwy 36		
4	Cookson Res. near dam		
5	Cookson Res. discharge @ concrete pad		
6	East Poplar R. @ border*	Annually	Cu, Zn, Pb, Ni, Cd, F, Cr, Al, Hg, Mo, Se, V, As, Oil and Grease

*IWD, Federal Department of the Environment proposes to have monthly monitoring of the East Poplar River at the border for physical, major ions, nutrients, metals and bacteriological quality. These data will be incorporated into the information exchange.

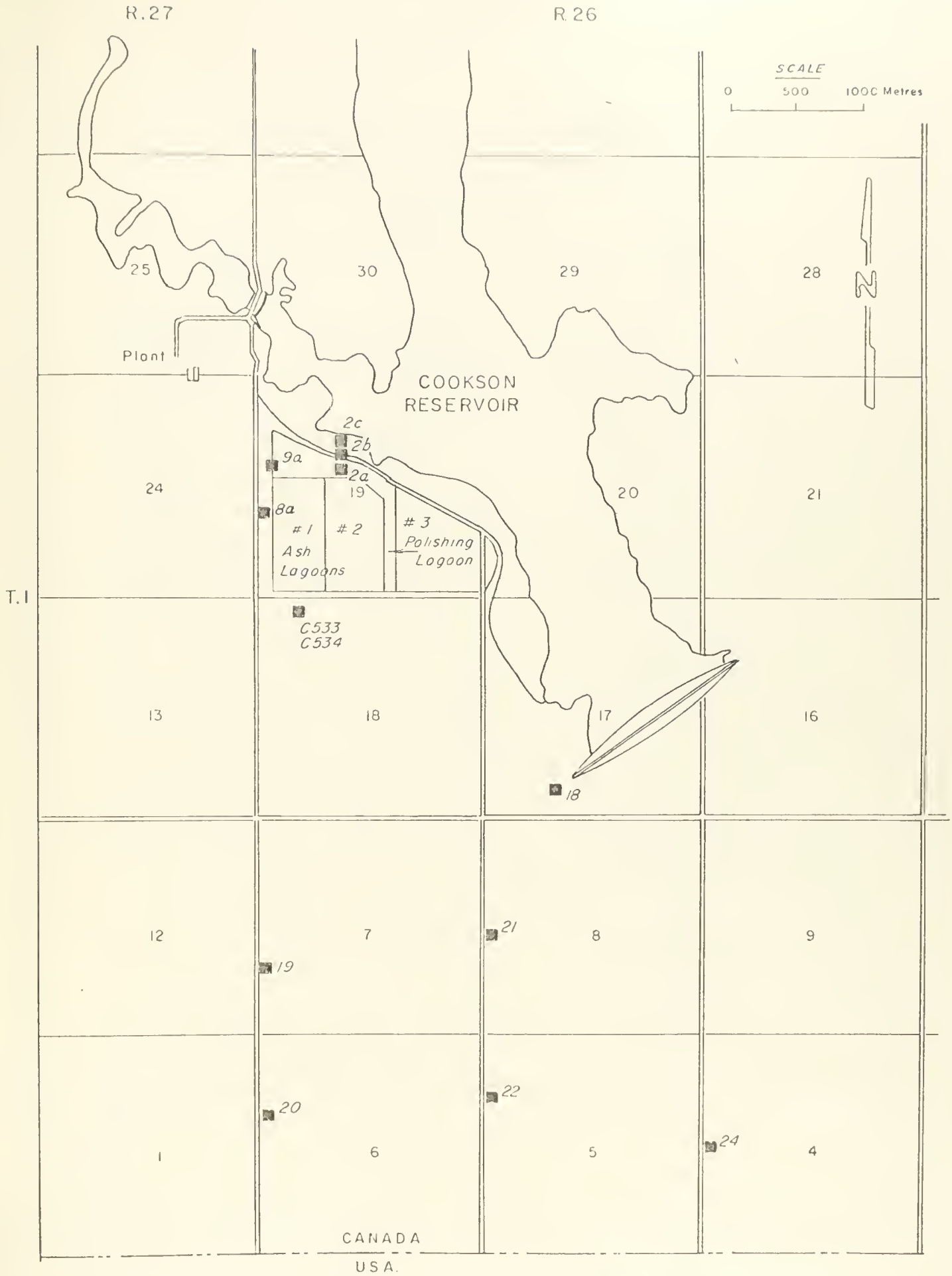
SURFACE WATER QUALITY MONITORING STATIONS

GROUNDWATER QUALITY MONITORING

Responsible Agency: Saskatchewan Environment

STATION	SAMPLING FREQUENCY	PARAMETERS
8a - beneath ash lagoon #1 consists of four piezometers into the till and 1 into the Empress formation)	*Annual	- water level, pH, cond., major ions, TDS, Total alk/acidity, NO_3, color, B, Ba, F, Fe, Cu, Mn, Zn, Cd, Cr, Al, Pb, Hg, Mo, Sr, Co, Se, V, silica, As, U, Li
9a - beneath polishing lagoon (consists of 4 piezometers into the till and 1 into the Empress formation)	*Annual	- as above
2a, 2b, 2c - between ash lagoon No. 1 and Cookson Res. (each location to be a single piezometer into the till or one within a nest of piezometers)	*Annual	- as above
C533, C534 - south of ash lagoon No. 1 (consists of 1 piezometer into the till and 1 into the Empress formation)	*Annual	- as above
Nos. 18, 19, 21 - one piezometer into the Empress formation near the dam, in Section 7 and Section 8 respectively (NB - these locations would give good coverage of reservoir/lagoon seepage towards the border. Alternative locations are Nos. 20, 22, 24 closer to the border)	*Annual	- as above

*First year sampling to be spring, mid-summer, fall and annually in fall thereafter unless unusual data warrant increased frequency. The first year of sampling would be considered to begin when the polishing lagoon and ash lagoon No. 1 are put into use.

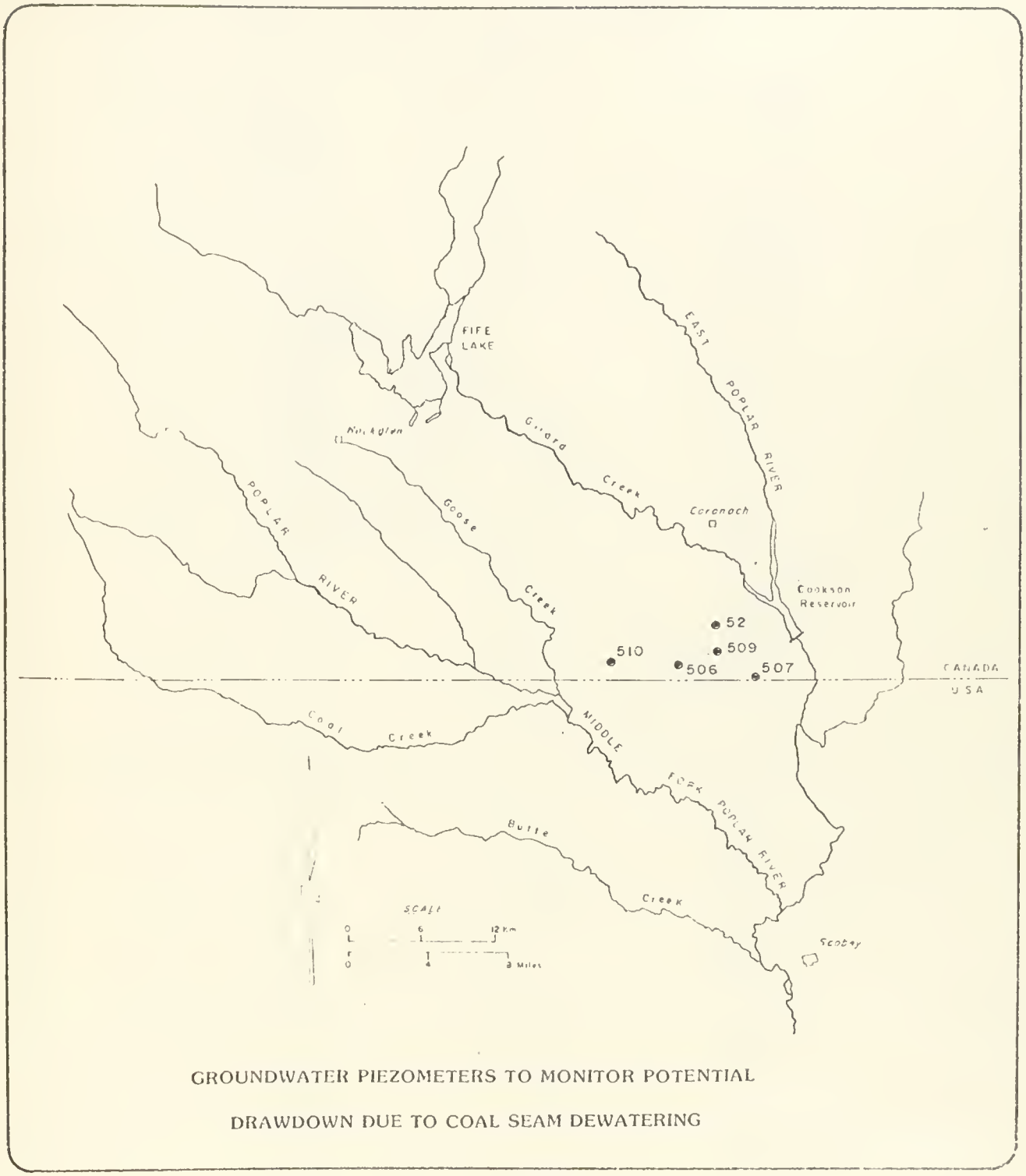


GROUNDWATER QUALITY MONITORING

GROUNDWATER PIEZOMETERS TO MONITOR POTENTIAL DRAWDOWN DUE TO COAL SEAM DEWATERING

Responsible Agency: Saskatchewan Environment

No. on Map	Location	Perforation Zone (depth in feet)	Measurement Frequency
52	NW14-1-27W3	140 - 160 (in coal)	Monthly
506	SW4-1-27W3	266 - 270 (in coal)	Monthly
507	SW6-1-26W3	110 - 114 (in coal)	Monthly
509	NW11-1-27W3	248 - 252 (in coal)	Monthly
510	NW1-1-28W3	92 - 96 (in layered coal and clay)	Monthly



GROUNDWATER PIEZOMETERS TO MONITOR POTENTIAL

DRAWDOWN DUE TO COAL SEAM DEWATERING

GROUNDWATER PIEZOMETER LEVEL MONITORING - ASH LAGOON AREA

SCHEDULE A - PIEZOMETERS IN TILL

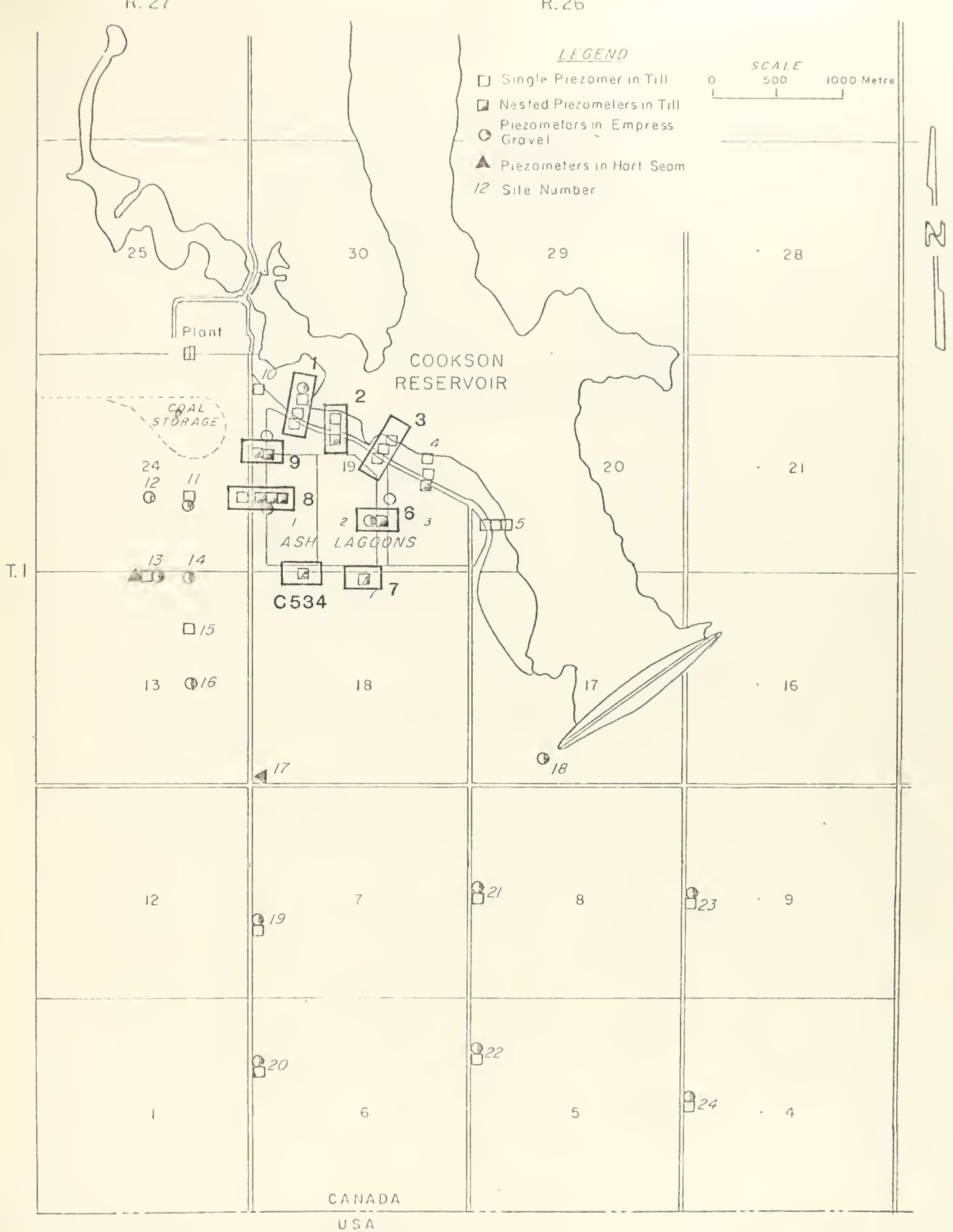
Responsible Agency: Saskatchewan Environment

PIEZOMETER	FREQUENCY IN MEASUREMENT 0-6 MO.	6-12 MO.
1a	Q	Q
1b	Q	Q
1c	Q	Q
$2a_1$	M	M
$2a_2$	M	M
$2a_3$	M	M
$2a_4$	M	M
2b	M	M
2c	M	M
3a	Q	Q
3b	Q	Q
3c	Q	Q
$6a_1$	Q	Q
$6a_2$	Q	Q
$6a_3$	Q	Q
$6a_4$	Q	Q
$7a_1$	Q	Q
$7a_2$	Q	Q
$7a_3$	Q	Q
$7a_4$	Q	Q
C534	M	M
$8a_1$	M	M
$8a_2$	M	M
$8a_3$	M	M
$8a_4$	M	M
$8b_1$	M	Q
$8b_2$	M	Q
$8b_3$	M	Q
$8b_4$	M	Q
$8c_1$	M	Q
$8c_2$	M	Q
$8c_3$	M	Q
$8c_4$	M	Q
8d	M	Q
$9a_1$	M	M
$9a_2$	M	M
$9a_3$	M	M
$9a_4$	Q	M
$9b_1$	Q	Q
$9b_2$	Q	Q
$9b_3$	Q	Q
$9b_4$	Q	Q

Beyond 12 months schedule to be revised based on need.

Q - quarterly

M - monthly



POPLAR RIVER POWER STATION ASH LAGOON MONITORING STUDY

PIEZOMETER INSTALLATION SITES
SCHEDULE "A" PIEZOMETERS IN TILL

GROUNDWATER PIEZOMETER LEVEL MONITORING - ASH LAGOON AREA AND INTERNATIONAL BOUNDARY AREA

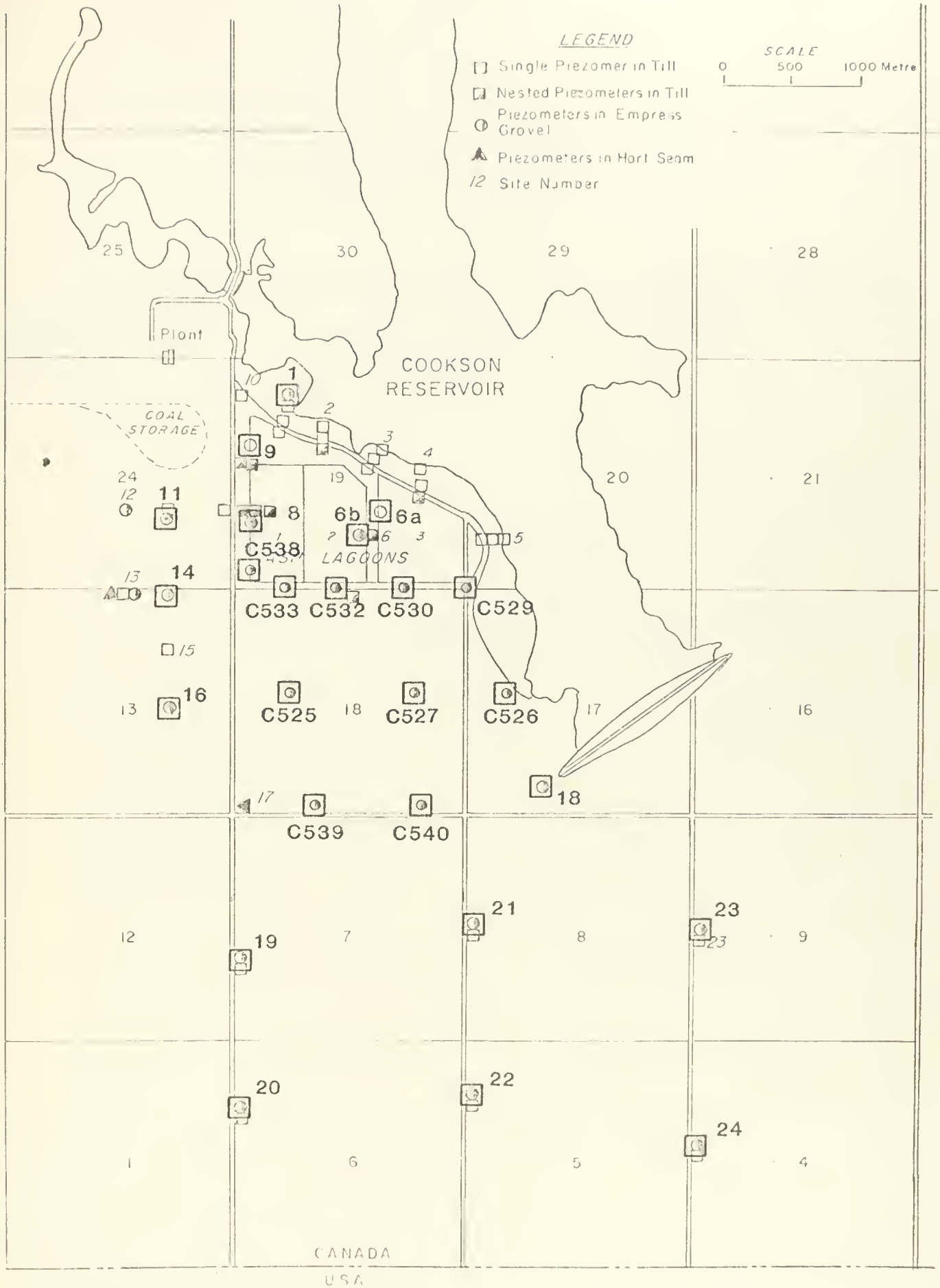
SCHEDULE B - PIEZOMETERS IN EMPRESS

Responsible Agency: Saskatchewan Environment

	FREQUENCY IN MEASUREMENT	
PIEZOMETER	0-6 MO.	6-12 MO.
Immediate Ash Lagoon Area		
1	Q	Q
6a	Q	Q
6b	Q	Q
C529	Q	Q
C530	Q	Q
C532	Q	Q
C533	M	Q
C538	M	Q
8	M	Q
9	M	Q
West of Ash Lagoon Area		
11	Q	Q
14	Q	Q
16	Q	Q
South of Ash Lagoon Area		
C525	Q	Q
C526	Q	Q
C527	Q	Q
C539	Q	Q
C540	Q	Q
18	Q	Q
19	Q	Q
20	Q	Q
21	Q	Q
22	Q	Q
23	Q	Q
24	Q	Q

Q - quarterly

M - monthly



POPLAR RIVER POWER STATION ASH LAGOON MONITORING STUDY

PIEZOMETER INSTALLATION SITES
SCHEDULE "B" PIEZOMETERS IN EMPRESS

AMBIENT AIR QUALITY MONITORING

Responsible Agency: Saskatchewan Environment

No. on Map	Location	Sampling Frequency	Parameters
1	Coronach	Hourly averages Summary statistics (24 hour for TSP)	Sulfur dioxide Total suspended Part.

METHODS

Sulfur Dioxide	As approved by Saskatchewan Environment - continuous
Total Suspended Part.	As approved by Saskatchewan Environment - 24-hour sample once/6 days

AMBIENT AIR QUALITY MONITORING

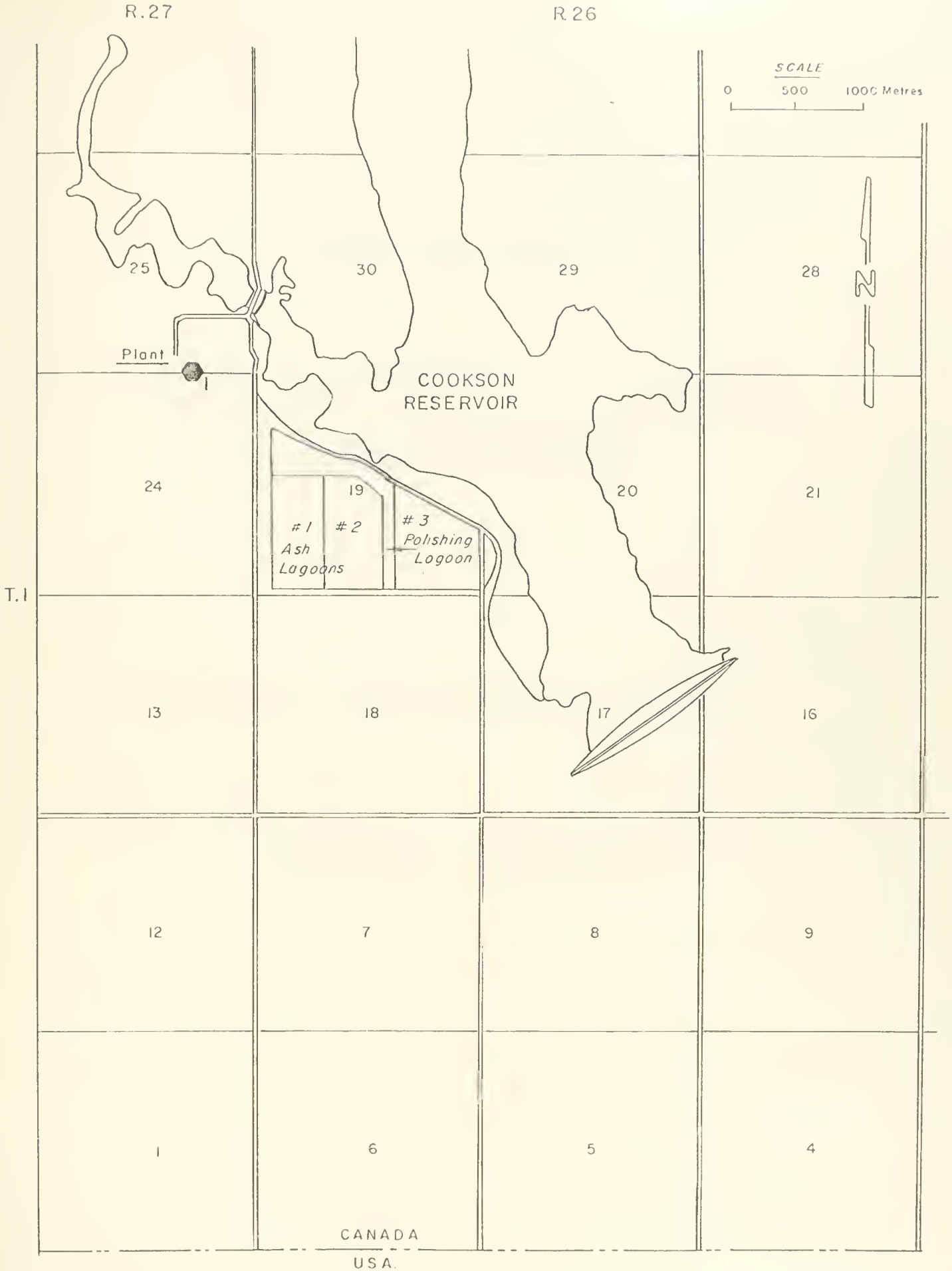
SOURCE EMISSION MONITORING

Responsible Agency: Saskatchewan Environment

No. on Map	Station Location	Sampling Frequency	Parameters
1	At Poplar River Power Plant	Hourly Averages	Sulfur Dioxide, Nitrogen Dioxide, Opacity, Oxygen or Carbon Dioxide

METHODS

Sulfur Dioxide	As specified by Saskatchewan Environment
Nitrogen Dioxide	As specified by Saskatchewan Environment
Opacity	As specified by Saskatchewan Environment
Oxygen or Carbon Dioxide for conversion factors	As specified by Saskatchewan Environment



SOURCE EMISSION MONITORING

POPLAR RIVER

COOPERATIVE MONITORING ARRANGEMENT

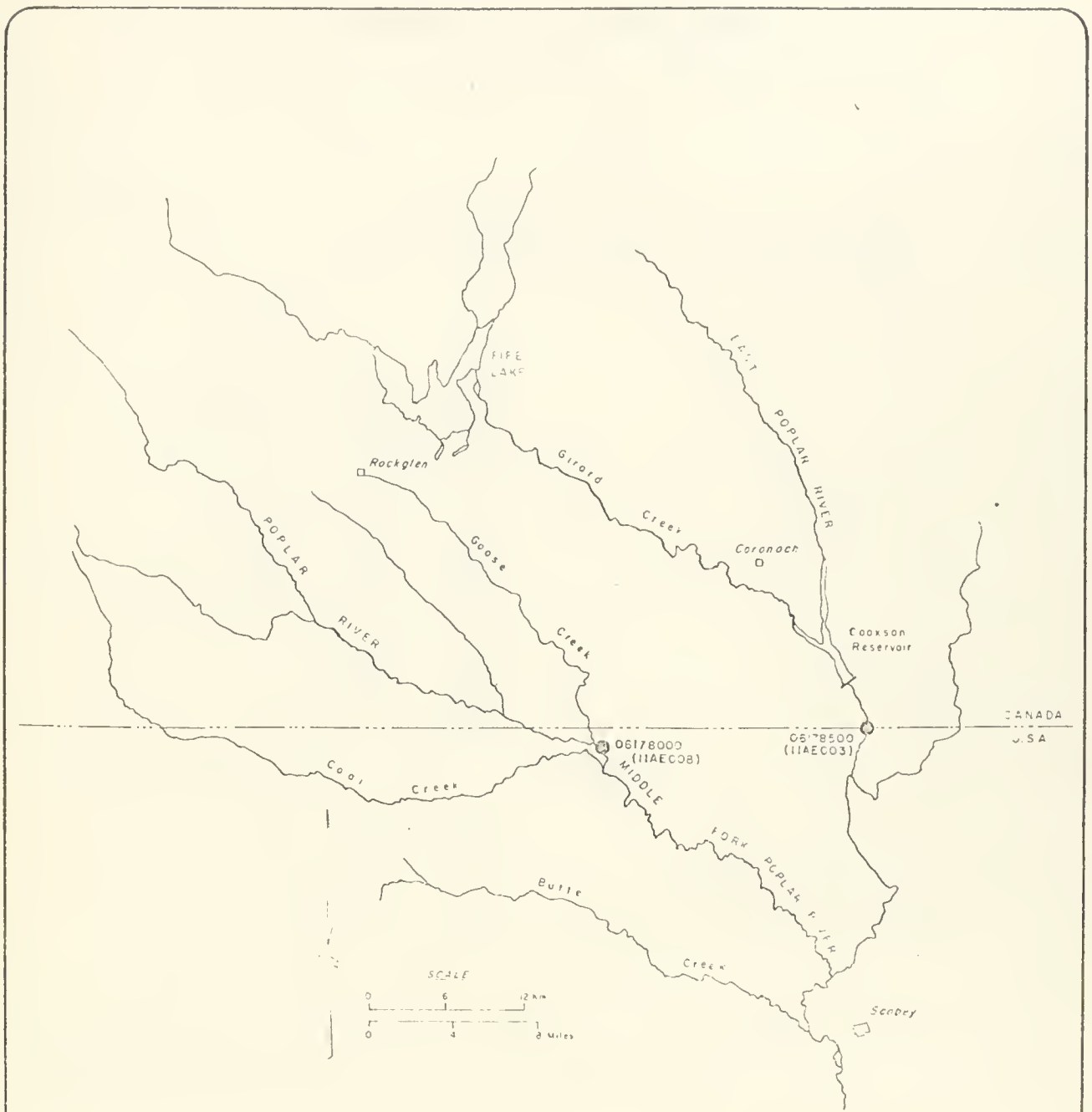
TECHNICAL MONITORING SCHEDULE

UNITED STATES

STREAMFLOW MONITORING AT HYDROMETRIC GAUGING STATIONS

Responsible Agency: United States Geological Survey

Map Number	Station Name
06178000 (11AE008)	Poplar River at International Boundary
06178500 (11AE003)	East Poplar River at International Boundary



HYDROMETRIC GAUGING STATIONS

SURFACE WATER QUALITY MONITORING

Responsible Agency: United States Geological Survey

Number on Map	Station
06178000	Poplar River at International Boundary
06178500	East Poplar River at International Boundary
06179000	East Poplar River near Scobey

do we still need these?
+ 3 others 1) Indians → USGS → USGS

Monthly (11 per year)

00061	discharge
00400	pH
00010	temperature, continuous
00070	turbidity
00300	dissolved oxygen
00095	specific conductance
80154	suspended sediment
00915	calcium
00925	magnesium
00930	sodium
00935	potassium
00410	alkalinity
00945	sulfate
00940	chloride
00955	silica
01020	boron
00630	nitrate-nitrite, total
00605	organic nitrogen, total
00610	ammonia nitrogen, total
00671	orthophosphate, dissolved

Quarterly

01000	arsenic, dissolved
01025	cadmium, dissolved
01030	chromium, dissolved
01040	copper, dissolved
01046	iron, dissolved
01049	lead, dissolved
71890	mercury, dissolved
01065	nickel, dissolved
01145	selenium, dissolved
01090	zinc, dissolved
00950	fluoride
32230	chlorophyll A
32231	chlorophyll B

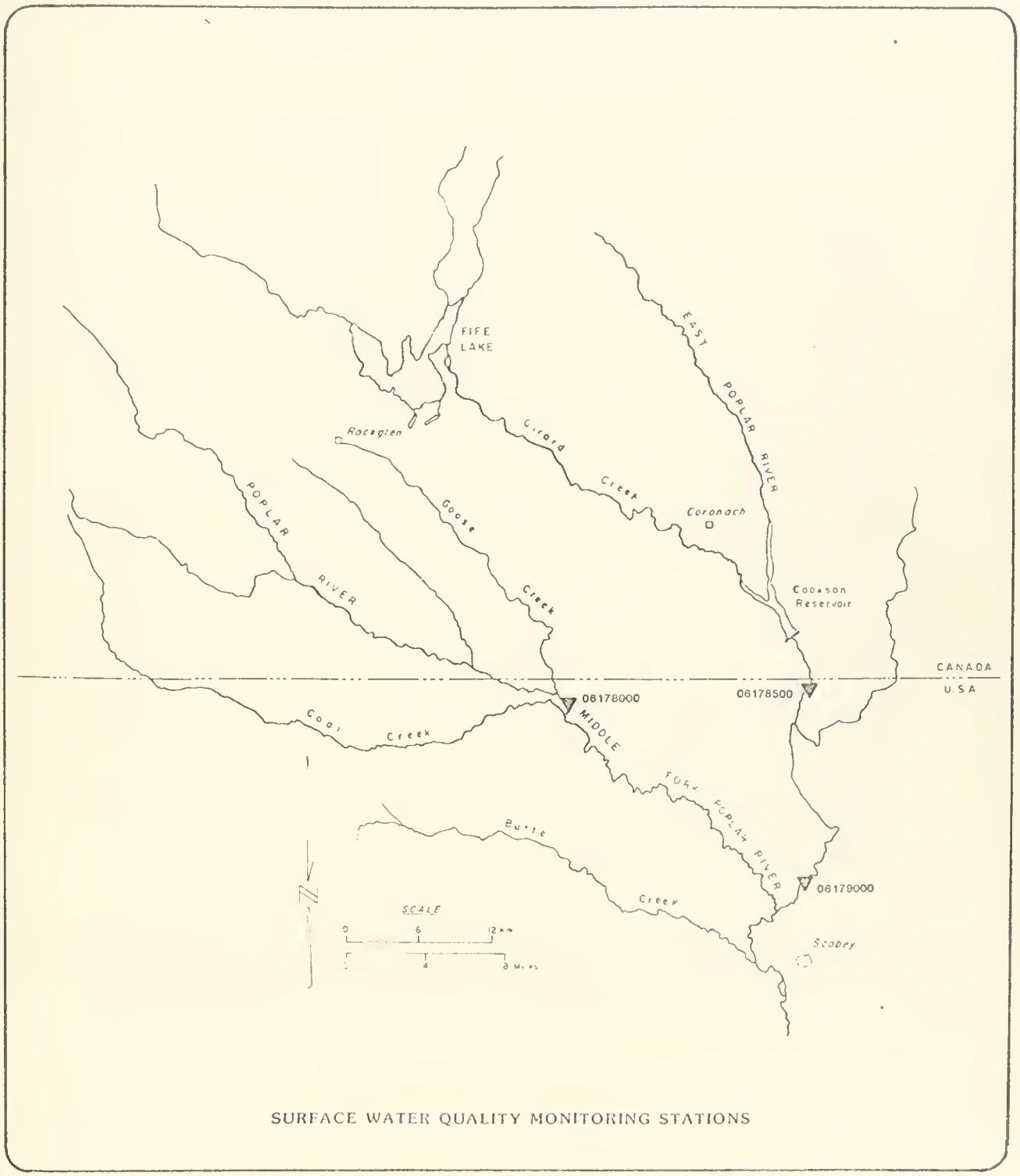
2/year (early & late spring)

01002	arsenic, total
01027	cadmium, total
01051	lead, total
71900	mercury, total
01147	selenium, total

Annual (late summer)

24 hour continuous monitoring of dissolved oxygen and temperature

Analytical methods and precision given in: U.S. Geological Survey, Methods for determination of inorganic substances in water and fluvial sediments: Techniques of Water-Resources Inv., book 5, chap. A1, 626 p.



SURFACE WATER QUALITY MONITORING STATIONS

GROUNDWATER QUALITY MONITORING

Responsible Agency: United States Geological Survey

Parameters for Standard Analyses

- pH
- conductivity
- silica
- sodium
- potassium
- calcium
- magnesium
- iron
- manganese
- bicarbonate
- carbonate
- sulphate
- fluoride
- chloride
- nitrates

Trace Metals

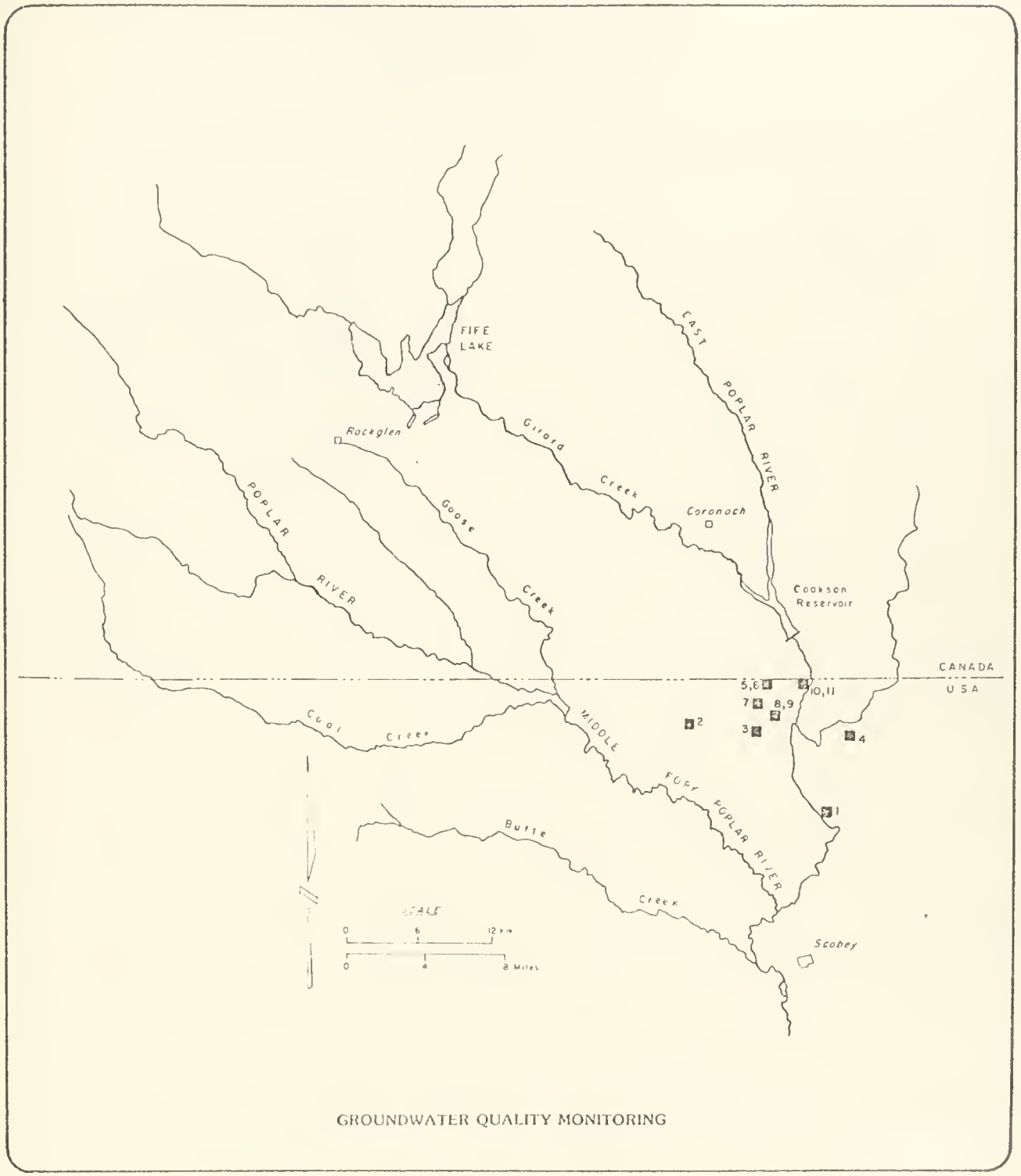
- boron
- selenium
- lead
- copper
- zinc
- molybdenium
- uranium
- lithium
- strontium

Sampling

Sampling frequency - Semi-Annually wells 5, 6, 10 & 11 in 1980, wells 2, 3, 7 & 8 in 1981 and 1 to 11 in 1982

Determine chemical analysis semi-annually

Analytical methods and precision given in: U.S. Geological Survey, Methods for determination of inorganic substances in water and fluvial sediments: Techniques of Water-Resources Investigations, book 5, chap. A1, 626 p.



GROUNDWATER QUALITY MONITORING

GROUNDWATER LEVELS TO MONITOR
POTENTIAL DRAWDOWN DUE TO
COAL SEAM DEWATERING

Responsible Agency: United States Geological Survey

No. on Map	Sampling
1 to 11	Sampling frequency Wells 5, 6, 10 & 11 in 1980, Wells 2, 3, 7 & 8 in 1981 and Wells 1 to 11 in 1982 Determine water levels quarterly

GROUNDWATER PIEZOMETERS TO MONITER POTENTIAL

DRAWDOWN DUE TO COAL SEAM DEWATERING

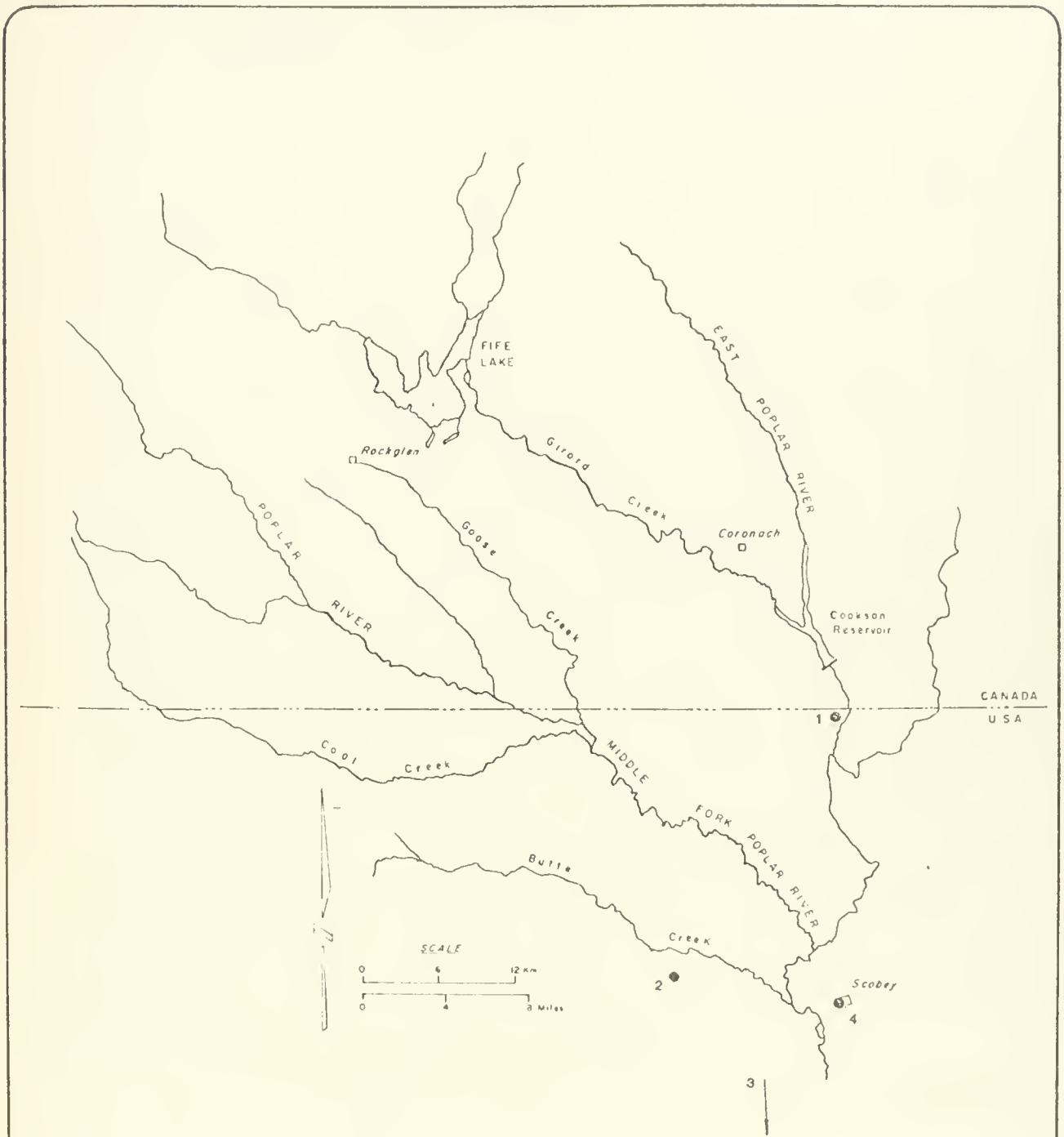
AMBIENT AIR QUALITY MONITORING

Responsible Agency: State of Montana
Air Quality Bureau

No. on Map	Location	Sampling Frequency	Parameters
1	Border Station	Hourly averages Summary statistics (24-hour for TSP)	Sulfur Dioxide Total Suspended Part. Visibility Wind Speed and Dir. Atmosphere Stability Fine Particles
2	~~Square~~ ~~Four~~ FOUR Buttes	Hourly averages Summary statistics (24-hour for TSP)	Sulfur Dioxide Total Suspended Part.
3	Ft. Peck Reservation	Hourly averages Summary statistics (24-hour for TSP)	Sulfur Dioxide Total Suspended Part.
4	Scobey	Hourly averages Summary statistics (24-hour for TSP)	Sulfur Dioxide Total Suspended Part.

METHODS

Sulfur Dioxide	EPA Equivalent Method EQSA-0276-009 - continuous
Total Suspended	EPA Reference Method CFR Title 40 Part 50 Appendix B (State of Montana QA Manual Section 1.1.10 and 1.2.10) 24-hour sample once/6 days
Visibility	State of Montana QA Manual Section 1.1.7 and 1.2.7 (Nephelometer) - continuous
Atmospheric Stability	State of Montana "Montana Air Resources Modeling System" August, 1979 (acoustic radar) = 2-hour averages
Fine Particles	State of Montana QA Manual Section 1.1.11 and 1.2.11 (dichotomous sampler) - 24-hour sample once/6 days



AMBIENT AIR QUALITY MONITORING